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Cris dos Remedios; a Driving Force in Muscle Research

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Back Row: Anne D'Albis, Cris dos Remedios, Roger Craig, Peter Knight, John Haselgrove, Pauline Bennett, Howard White, John Sleep, Gerald Offer, Sam Lehrer. Middle row (kneeling): Carl Moos, Jane Koretz, David Marsh, Peter Vibert, Ed O'Brien. Front row (sitting): Frank Pepe, John Trinick, Jean-Marie Gillis, John Squire, Vic Small, Ichiro Matsubara. Photo used by generous permission of Jean-Marie Gillis.

I first met Cris in the mid '70s when he came to King's College London, Biophysics Department, Drury Lane on a sabbatical to work with Walter Gratzer and Jeni Fordham on actin. He came with an interest in the effect of rare earth elements on the organisation of actin. In London he worked with Michael Dickens to obtain EM images of tubes of actin formed in the presence of gadolinium which gave detailed diffraction patterns and revealed the shape of the G-actin monomer (dos Remedios and Dickens 1978). Cris, in his larger-than-life way, was fun to work with and enjoyed driving round London with his wife, Trish, in his Citroën DS, which he intended to ship back to Australia. In 1978 he attended the Muscle Gordon Conference held in Plymouth, New Hampshire. All the delegates there

who had worked or studied in Drury Lane were rounded up for the photo shown. Here we can see Cris with many of the illuminati of muscle research, then and now. More than half of those pictured continued to work on muscle and have made substantial contributions, mainly in the area of structural and functional studies of sarcomeric proteins.

Although Cris has co-authored papers with only a few of them, his broad interest in many muscle related issues through his long career will have touched on all our research. Probably the practical project that has had the most influence has been the generation of the Sydney Heart Bank (Dos Remedios et al. 2017). This has been the source, generously distributed, of both control and diseased human heart tissue for many investigators and has led to many publications.

My own use of this resource began in early 2000s when I started working on the spectrin complex in cardiac muscle with Jeni Fordham and Anthony Baines. We found that spectrin αII was strongly represented at the intercalated disc where heart muscle cells join end to end. This led to a long-term interest in the structure of the intercalated disc, an interest also shared by Cris (Estigoy et al. 2009). The membranes of neighbouring cardiomyocytes are locked together at the intercalated disc where they interdigitate in complex folds. In animal models of dilated cardiomyopathy, the structure of the intercalated disc becomes more disordered with much greater fold dimensions. Within the folds there is evidence of sarcomere formation, and there are changes in mitochondria organisation near the intercalated disc. We were able to confirm these observations in human heart muscle samples from the Sydney Heart Bank (Wilson et al. 2014).

Myofibrils, mitochondria and sarcoplasmic reticulum have a clear relationship to the intercalated disc structure by means of a transitional junction which involves Z-disc proteins including N-terminal titin (Bennett 2018). Titin stretches from Z-line to M-line and acts as a blueprint for the sarcomere as described in a recent historical review by Cris (Dos Remedios and Gilmour 2017). Cris has been a strong advocate for this 'third' filament in striated muscle, working on it for his PhD, and in an early publication showed by electron microscopy the filamentous network remaining when actin and

myosin were extracted from myofibrils (dos Remedios and Gilmour 1978). He championed the work initially carried out in Japan on connectin (titin). He has stayed true to this early interest and in recent years has been involved with several studies on the interactions of titin and the way that phosphorylation controls its function in the heart.

I am not sure which distinctive car Cris now drives but I'm sure he will drive both himself and his group with the same infectious energy in his 'retirement'.

Bennett PM (2018) Riding the waves of the intercalated disc of the heart Biophysical reviews 10:955-959 doi:10.1007/s12551-018-0438-z

Dos Remedios C, Gilmour D (2017) An historical perspective of the discovery of titin filaments Biophysical reviews 9:179-188 doi:10.1007/s12551-017-0269-3

dos Remedios CG, Dickens MJ (1978) Actin microcrystals and tubes formed in the presence of gadolinium ions Nature 276:731-733 doi:10.1038/276731a0

dos Remedios CG, Gilmour D (1978) Is there a third type of filament in striated muscles? Journal of biochemistry 84:235-238

Dos Remedios CG et al. (2017) The Sydney Heart Bank: improving translational research while eliminating or reducing the use of animal models of human heart disease Biophysical reviews 9:431-441 doi:10.1007/s12551-017-0305-3

Estigoy CB et al. (2009) Intercalated discs: multiple proteins perform multiple functions in non-failing and failing human hearts Biophysical Reviews 1:43-49 doi:DOI 10.1007/s12551-008-0007-y

Wilson AJ, Schoenauer R, Ehler E, Agarkova I, Bennett PM (2014) Cardiomyocyte growth and sarcomerogenesis at the intercalated disc Cellular and molecular life sciences : CMLS 71:165-181 doi:10.1007/s00018-013-1374-5